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TECHNICAL REPORT
TARGETS FOR
TEAM SKILLS TRAINING

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TECHNICAL REPORT

TARGETS FOR TEAM SKILLS TRAINING

by

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This paper explores what the research literature has to say about improving team skills through training. Primary emphasis is placed on team training in military contexts although this literature is supplemented by other relevant research and review material.

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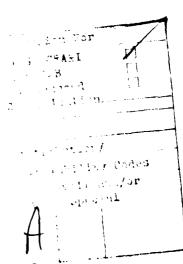DD FORM 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Block (20) Abstract   (con't)

The review points to team member coordination as practiced through communications as the central team skill theme. Both the frequency of occurrence and the content of coordination communications were found to differentiate between better performing and worse performing teams. Moreover, the research showed that through the introduction of appropriate support systems, teams could be trained to use targeted coordination communications more frequently.

The available team training research literature was found to be extremely limited. Therefore, more studies are recommended which explicitly operationalize coordination communications for a variety of tasks with clear performance criteria. An important element in such research involves the development of support systems such as strategy planning and team performance feedback mechanisms which encourage desired team coordination communications to take place.

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SUMMARY

This paper explores what the research literature has to say about improving team skills through training. Primary emphasis is placed on team training in military contexts although this literature is supplemented by other relevant research and review material.

The review points to team member coordination as practiced through communications as the central team skill theme. Both the frequency of occurrence and the content of coordination communications were found to differentiate between better performing and worse performing teams. Moreover, the research showed that through the introduction of appropriate support systems, teams could be trained to use targetted coordination communications more frequently.

The available team training research literature was found to be extremely limited. Therefore, more studies are recommended which explicitly operationalize coordination communications for a variety of tasks with clear performance criteria. An important element in such research involves the development of support systems such as strategy planning and team performance feedback mechanisms which encourage desired team coordination communications to take place.

INTRODUCTION

Team skills are inherent in every task which requires persons to work
together. In fact, a team skill can be defined as competence in working
with others to accomplish tasks requiring team member coordination. Moreover,
interactions between team members are a fundamental element in team skills.
Communications of one form or another are how team members exchange informa-
tion, obtain feedback on their previous task performance, and receive new
assignments among other necessary team task requirements.

Team training can play various roles in meeting task requirements for
team skills. At the most fundamental level, it can involve bringing persons
together and training them to perform a technical task which requires them
to interact. Or team training can focus more directly on team skills through
training material designed to develop these skills apart from any formal
technical task requirements. For example, many team-building and awareness
training programs are developed along these lines. The important point is
whether the team training provided helps to develop team skills which
contribute to effective team functioning and task performance. Team skills
in one form or another will always be practiced by team members when they
are performing a task which demands team member coordination. The question
to which this literature review is directed is what team skill targets have
been found to benefit through direct attention during training so that their
utilization by team members has paid off in measurable outcomes?

Our literature review strategy consisted of identifying military and
civilian training and group dynamics research studies where attempts have
been made to isolate the effects of specific team skills. Each relevant
study was examined using the team skill training model presented in Figure 1
as a guide to what to look for. This model outlines the classes of variables
which are relevant to the team training process. At the center of the model
is the training format itself consisting of the training techniques or inter-
ventions used to develop specific team skills. These techniques may vary from
formal classroom training to role playing exercises to task simulations.

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TRAINEE CHARACTERISTICS
1. Technical Skills &
   Experience
2. Team skills & experience
3. Motivation

TRAINING FORMAT
1. Training techniques
2. Interventions

TEAM CONTEXT
1. Team permanence
2. Team leadership

TRAINING TASK
1. Technical skills
2. Team skills

OUTCOMES
1. Technical skills
2. Team skills
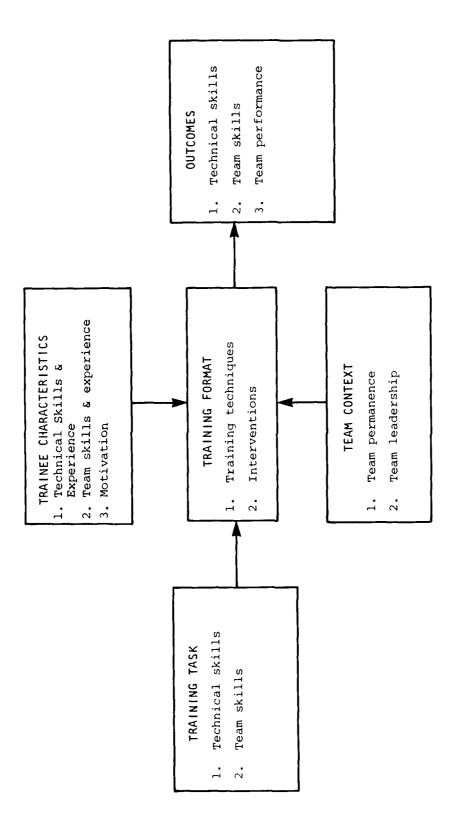3. Team performance

Figure 1. A Team Skills Training Model

Team skills training may be embedded within total task training or it may be separated out as a training element. Moreover, it is important to consider the manner in which team skills are defined or operationalized so that they can serve as clear targets for training techniques.

Surrounding the training format are three (3) variable classes which can contribute to the form which it takes. At the left of the model, we have the tasks and skills which are to be learned during training. As we noted earlier, for certain types of training, team skills may be sub-elements of the total technical task while for other types, the team skills themselves are the primary training targets. The second variable class focuses on characteristics of the persons being trained. These characteristics include not only technical skills and experience which trainees bring with them to training but also relevant earlier team skills training and experience. Also included is the motivation of team members to work together. The third variable class incorporates team context factors such as whether the team being trained is a permanent one which will remain intact after training. Moreover, if the team is intact, does it have a member who is formally in charge or not as will be the case during actual task performance?

The final consideration at the right of the model are the training outcomes. These outcomes may cover improvements in team skills like communications and increases in technical skill levels. However, the critical outcome is team performance. Therefore, team and technical skill acquisition need to be related to how effectively the team performs the training task. The best evaluation of training impact involves examining team performance of the target tasks in actual field conditions. However, because such evaluations are complex and costly, primary emphasis is usually placed on changes in team outcomes which occur during the course of training programs.

LITERATURE SELECTION

The team skills training model was placed in a matrix format to facilitate input from each study to every variable class. The variable classes include (1) team skills targetted in the study and how they are operationalized; (2) the training technique or intervention utilized; (3) the nature of the team task performed; (4) any relevant trainee or subject characteristics; (5) information on the team context; and (6) the measurable outcomes used to determine the impact of team skills training or interventions. The matrix with the selected studies placed into it is presented in Table 1. A total of fourteen (14) studies were included in the matrix. The primary selection criterion was that a study targetted specific team skills within a military context. Eight (8) studies qualified under this criterion.

The remaining six (6) studies addressed team skills within small group laboratory situations using civilian subjects. They did not utilize training techniques but instead incorporated some intervention in their design which was intended to influence targetted team skills. These studies were selected because they complemented or supported the team skill focus in the military training research studies. In several cases, they represent a larger body of laboratory research. We did not attempt to incorporate the entire group dynamics literature within the matrix because we did not find that this approach contributed to the primary focus on appropriate targets for team skills training in military contexts. Moreover, this literature has been adequately reviewed elsewhere (e.g., Collins, 1977; Nieva et al., 1978).

Many potentially relevant studies were eliminated from consideration for the matrix because of the absence of a clearly defined team skill focus. For example, a study by Fox and Lorge (1962) referred to team skills introduced during training simply as "group dynamics." In addition, a number of reviews have been written describing team functioning in military contexts. These reviews address specific team skills and discuss their contributions to effective team functioning. However, no actual interventions directed at team skills took place as part of these studies. We found this literature

I. General Interpersonal Team Skills

STUDY	TEAM SKILL TARGETS	TRAINING TECHNIQUE or INTERVENTION	TASK	
Winsted (1978)	1. Team Awareness 2. Role Identification 3. Decision Making 4. Leader-member Relations 5. Defining Future Objectives	Team building exercises with facilitator assistance.	Team skills improvement programs.	
Aplander (1975)	1. Role Identification 2. Planning 3. Organizing 4. Coordination	Questionnaire data feedback and discussion focusing on supervisor-subordinate differences in role perceptions.	Reduce survey data differences.	
Hackman & Kaplan Study II (1974)	Implicit vs. explicit maintenance of interpersonal relationships.	Groups encouraged to discuss team member relationships, goals and strategies prior to task performance.	"Advice Board" responding to human relations problems.	
Kaplan (1979)	Performance strategies. Expressive vs. Suppressive maintenance of interpersonal relationships.	Discussion groups directed towards a conversation about interpersonal skills prior to task performance.	"Advice Board" responding to human relations problems.	

TABLE 1

S TRAINING MATRIX

TASK	TRAINEE CHARACTERISTICS	TEAM CONTEXT	OUTCOMES
improvement	Four Navy and Coast Guard teams.	Intact teams	No significant differences in such survey indicators as command communications, *decision making, and peer group* facilitation in comparison with control groups. However, control groups were also undergoing a form of team development.
ey data	Civilians in four industries.	Supervisors and their subordinates	More similar supervisor - subordinate role perceptions as revealed by the readministration of questionnaire.
rd" responding elations problems.	Undergraduates; male and female.	Temporary teams	Team members attained *more* satisfaction in interpersonal discussion groups but also found group activity taxing. In addition, these groups had lower performance quality than groups where no discussion of interpersonal issues was allowed.
ard" responding relations problems.	Undergraduates	Temporary teams	No significant differences in such areas as task performance, task experience, satisfaction, and knowledgeability about social interaction of group. Experimental groups were more emotionally taxed after discussion of interpersonal relationships.

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II. Communications as a Team Skill

STUDY	TEAM SKILL TARGETS	TRAINING TECHNIQUE OR INTERVENTION	TASK	C
Briggs & Johnston (1966) Williges, Johnston & Briggs (1966)	Verbal communications opportunity	Open or closed verbal communications channel.	Radar control simulator	2- P t
Guetzkow & Dill (1957)	Organizational efficiency	Written communications channels available or unavailable.	Group process to determine missing piece of information through message exchange.	5- u e st

TASK	TRAINEE CHARACTERISTICS	TEAM CONTEXT	OUTCOMES
control simulator	2-person Air Force pilot radar control teams	Temporary teams.	Communications facilitated team performance only when a more efficient information channel (e.g. visual display) was not available.
process to determine piece of information message exchange.	5-man teams of undergraduate engineering students	Temporary teams.	Open communications enhances organizational planning.

III. Coordination Communications as a Team Skill

STUDY	TEAM SKILL TARGETS	TRAINING TECHNIQUE OR INTERVENTION	TASK
Krumm & Farina (1962)	Coordination through communications.	Interactions integral to task.	B-52 flight simulator
McRae (1966)	Coordination through communications.	Interactions integral to task.	Switch coordination.
Federman & Siegel (1965)	Coordination through communications.	Interactions integral to task.	Helicopter anti-sub warfare simulator.

TASK	TRAINEE CHARACTERISTICS	TEAM CONTEXT	OUTCOMES
ulator	Pilot and navigator crews.	Intact teams.	More effective crews used more messages containing planning, opinions, and evaluation There was no significant difference in communication volume.
ation.	Army enlisted men.	Temporary teams.	More effective teams specified more actions and exchanged more information. No significant differences among teams in specifying procedures for task accomplishment. and performance efficiency.
sub warfare	6-man Navy flight teams.	Intact teams.	More efficient crews exchanged more information and opinions for coordination. They were also more willing to modify their behavior and change their views as a function of different options.

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IV. Support Systems, Coordination Communications, and Performance

STUDY	TEAM SKILL TARGETS	TRAINING TECHNIQUE OR INTERVENTION	TASK	TRAIN CHARACTE
Siegel & Federman (1973)	Coordination and adaptation through communications.	Team follow-up discussions of simulator problems and effective communications. Role playing of communications situations.	Helicopter anti-sub warfare simulator.	6-man Nav flight tea
Thurmond & Kribbs (1978)	Coordination under emergent task conditions.	Team debriefing to discuss performance and roles.	Computer assisted coordinated training scenarios.	2 man Ar teams
Shure, Rogers, Larsen & Tassone (1962)	Planning for task accomplishment.	Varied allotment of time for planning and organizing for task.	Discovery of common symbol among team members.	5 man tea undergradu students.
Hackman, Brousseau & Weiss (1976)	Task strategy planning.	Groups given reading materials and initial structure to develop strategy planning skills.	Team effort to assemble various electrical components from "order lists"	4 man tea undergradu student

ASK	TRAINEE CHARACTERISTICS	TEAM CONTEXT	OUTCOMES
sub warfare	6-man Navy flight teams.	Intact teams.	Teams with follow-up training made more use of coordination communications. However, there were no performance differences between follow-up and non-follow-up teams.
ted coordinated ios.	2-man Army teams	Temporary teams.	Performance efficiency was better for teams receiving coordinated training but only on tasks requiring coordination
ommon symbol embers.	5-man teams of undergraduate students.	Temporary teams.	Groups with planning time allocated were more effective and showed a reduction in redundant and inefficient messages across trials.
assemble l components ts"	4 man teams undergraduate students.	Temporary teams.	When team members had unequal task information, explicit strategy discussion teams had higher productivity. These teams also showed more flexibility in approaches to task accomplishment, shared leadership, and more interaction.

to be helpful in defining team skills and describing team skill relationships.
Implications of these studies for the research findings derived from the
matrix will be discussed later.

TEAM SKILLS LITERATURE REVIEW

We have divided the matrix studies into four (4) categories. In each category, we have first presented the research which was conducted in a military training context. Following this research, we have listed a representative sample of studies conducted with temporary teams which have implications for Navy team skills training. The first set of four studies address a variety of team interpersonal skills at a general level. No clear-cut improvements in team performance are attributable to the team skills training and interventions which take place in these studies. The second set of three studies look at communications as a team skill and suggest that competence in communications involves more than simply giving team members the opportunity to communicate. The third set of three studies focuses more specifically on communications content as it serves teams to achieve effective coordination. The fact that there are differences in communications content between more effective and less effective teams suggests that focusing on interactions in team skills training is a promising path to pursue for improving team performance. The final set of four studies show that training or other team interventions which support or encourage certain types of critical team member interactions to take place can, in fact, produce this desired team skill impact. These changes in team inter-actions are shown to relate to improvements in team performance.

Turning now to an examination of the first set of studies, we find that the training technique or intervention running throughout consists of some form of team member discussions intended to improve interpersonal skills. In a study involving Navy personnel, Winsted (1978) tried to improve team effectiveness through team building exercises. These exercises, covered within a program called Task Oriented Team Development (TOTD), addressed team awareness, role identification, decision-making, and leader-member relations. No significant performance differences were found between the four Navy and Coast Guard teams engaging in the program and control groups. However, the control groups were receiving another version of team development exercises at the same time. Moreover, as Winsted points out, the exercises did not appear relevant to Navy tasks.

In other studies representing the focus on team skills per se, Aplander (1975) attempted to reduce the differences in supervisor-subordinate role perceptions through team discussions of questionnaire data collected from the participants. The data addressed such issues as planning, organizing, role identification, and team and management effectiveness. A post-discussion survey indicated more similarity in role perceptions but no measures of team performance were taken.

The third and fourth studies examined strategies for maintaining inter-personal relationships in teams through group discussions. Hackman and Kaplan (1974, Study II) maintained that adaptive maintenance encouraging discussions of team member relationships would improve satisfaction and team performance. They found that while teams which engaged in such discussions were more satis-fied, the performance of control teams was superior. Hackman and Kaplan assumed that for different types of tasks requiring more emotional involvement, the discussions would contribute to performance improvements. In a later study, Kaplan (1979) focused the discussions more specifically on the nature of social interactions occurring within a team. However, again no significant performance differences were found between experimental and control groups for the same task.

These research studies deal with interventions which target team skills outside of the context of formal operational task requirements. The assumption is that team skills development within this context will generalize to team performance of formal tasks. This assumption characterizes a broad range of team building programs currently available which have evolved from the sensitivity training tradition. Campbell and Dunnette (1968) have reviewed the research evidence for this type of team skills training and concluded that while it does seem to produce observable behavioral changes, its utility for improving performance has yet to be demonstrated. They go on to say that the type of interpersonal sensitivity which the training addresses needs to be better defined and related to specific task contexts. In a more recent review, Smith (1970) indicated that Campbell and Dunnette's conclusion remains accurate. Therefore, the type of team skills training represented by the rest set of studies which address interpersonal skills at a general level

outside of a specific task context do not show any consistent relationships
to team performance.

The second set of studies deal with communications as a team skill.
Communications may be viewed as the central element of team skills since
all team member relationships must occur through some form of interpersonal
interaction. This set of studies focuses upon opportunities for team
members to communicate.

Two similar studies examined the extent to which verbal communications
facilitated team task performance in a radar control simulator. Briggs and
Johnston (1966) and Williges, Johnston, and Briggs (1966) conducted studies
which indicated that verbal communications facilitated team performance
only when a more efficient information channel was not available. In this
case, that channel involved visual information display. Verbal communica-
tions only served to add "noise" to the system.

Guetzkow and Dill's (1957) study fits within the context of the
extensive volume of research on communications networks. They examined the
effects of varied opportunities for team members to exchange written informa-
tion on team performance by opening or closing channels between members.
Their results showed that greater opportunities for communications encouraged
team member strategy planning and selection of the best persons for
particular positions. This supports the conclusion reached by Shaw (1971) in
his review of communications network research. He found that a decentralized
network was most efficient for solving complex problems while a centralized
structure worked best for simple problems. The type of planning and task
assignment activities found by Guetzkow and Dill in open channel networks
can be viewed as contributing to the development of appropriate team
processes for complex types of tasks.

The third set of studies focuses on the content of communications as it
relates to team performance. The team skill referred to in all three studies
included here is coordination. All of the studies focus on military personnel
performing different tasks. In addition, all of them involve content analyses

of team members interactions to help understand the nature of coordination
as a team skill.

Krumm and Farina (1962) examined communications among pilot and
navigator crews during training in B-52 flight simulators. Using objective
performance measures to differentiate between good and bad crews, they found
that the more effective crews made use of more messages containing information
on courses of action, opinions, and evaluations.

McRae (1966) found somewhat different results than Krumm and Farina
examining Army teams performing a switch coordination task. She found that
rather than emphasizing organizational types of content, more effective teams
exchanged more information concerning task specific issues rather than
organization or planning issues. In fact, organizational communications were
of low volume and varied little across task trials. As these results were
not what she had predicted, McRae offered several possible explanations.
Among them was the nature of the task itself which may have had too few
dimensions and responses requiring organizational communications. Secondly,
the more productive teams may have engaged in the coordination stage early
in their interactions and developed an effective system requiring little in
the way of organization communications during later task trials. In fact,
evidence of this type of communications later on may indicate a failure on
the part of a team to effectively coordinate their activities.

Finally, Federman and Siegel (1965) examined the communications content
of Navy flight crews in a helicopter anti-submarine warfare simulator. Their
primary interest was in coordination as the team skill expressed through
communications. For this type of training task, the researchers found more
evidence of information and opinion interchanges in teams performing more
proficiently. In addition, more of the information and opinions provided in
these teams were in response to specific requests from team members than in
less proficient teams. Also of interest is the finding that more proficient
teams showed a greater tendency to modify behavior and break mental sets as
a result of discussions focusing on opinions (e.g., "it seems to me...") and
options (e.g., "what would happen if...").

The content analyses performed in these three studies demonstrate that the team skill of coordination as operationalized through team member communications content does differentiate between more effectively performing and less effectively performing teams. This is an important point in and of itself. It indicates that there is potential benefit to be gained from team skills training which focuses on improving team proficiency in coordination communications. Moreover, for the tasks examined, specific types of important communications include competence in organizing, information exchange, planning, and evaluating options.

The final set of four studies examines actual team interventions targetted at team skills with the objective of improving team performance. The first two studies involve actual military training situations while the second two represent research conducted in small group laboratory settings.

Siegel and Federman (1973) followed up the Federman and Siegel study described in the last section by attempting to improve team competence in using the types of communications found to differentiate between more proficient and less proficient crews. Post-task team member structured discussions and role playing exercises were used to stress critical communications for experimental groups of Navy flight crews. Examination of data collected from experimental teams and control teams where no team skills training was introduced showed significant differences in the use of the targetted communications. However, no performance differences were discovered perhaps because the control teams had more initial experience performing the anti-submarine warfare simulation task. While the performance differences were not significant, the utility of custom tailoring communications content to task training was demonstrated in this study.

Coordinations as a team skill was also the target of training examined by Thurmond and Kribs (1978). The training task involved Army artillery tactical firing simulations under integrated and emergent team conditions. The researchers introduced team debriefings which focused on discussions of past performance and future role assignments. While there was no direct determination of team skill acquisition in terms of team member interactions

or activities, team performance was better for teams receiving the special
training. The effect was only significant for task simulations where
coordination was necessary.

Both of the above studies focused on the development of team skills
during training by providing special opportunities for team members to discuss
their relationships and develop coordination strategies for accomplishing
tasks. The importance of making such provisions was also demonstrated in two
small group laboratory studies. Shure et al. (1962) varied time provided
teams to plan and organize themselves. They found that groups given separate
planning time performed the experimental task significantly faster than other
groups. The trained teams developed a more consistent information and answer
exchange system. In the second study, Hackman et al. (1976) first trained
teams in strategy planning using material especially developed for the task-
at-hand. They found that the teams so trained demonstrated more flexibility
in their approaches to the task, had more shared leadership, and interacted
more than other teams. They were also more productive but only for tasks
structured so as to require team member coordination. The researchers also
emphasized the importance of custom tailoring the strategy-planning activity
to task conditions if it is to "take" with team members feeling comfortable
using it.

The last set of studies demonstrates that team skills targetted training
can produce the intended change in team member interactions. There is
potential for team performance improvement as well although the Siegel and
Federman results were not statistically significant. Moreover, these studies
emphasize the importance of establishing an appropriate structure or support
system for the development of desired coordination team skills. This system
involved structured post-task team member discussions in the Siegel-Federman
and Thurmond-Kribs studies. The Shure et al. and Hackman et al. studies con-
centrated on pre-task strategy planning discussions among team members. All
of the studies custom-tailored these sessions to the task before the team
which in each case required coordination among team members.

SUMMARY OF RESEARCH FINDINGS

In summary, the research studies which we have included within the
matrix suggest a number of conclusions about the nature of team skills
training. First of all, team skill interventions which are not tied directly
to formal task requirements are likely to have minimal impact on team perfor-
mance. Secondly, team member coordination as practiced through communications
is the central team skill theme running through the research. However, the
frequency of occurrence and content of the communications make a difference
in team performance. Too much communications where the task does not require
it can be just as dysfunctional as too little communications of the type
required for task accomplishment. The content of effective coordination
communications includes organizing, exchanging task-related information,
and evaluating options although the exact "mix" varies from task to task.
The fact that good teams can be differentiated from bad teams in terms of
these categories reinforces their contribution to team performance. Finally,
it was shown that teams could be trained to use targetted coordination
communications more frequently. Appropriate support systems were found to
aid in this effort. Structured discussions focusing on task performance
and strategy planning were the types of systems relied upon. During strategy
planning sessions, team member interactions dealt with courses of action to
take, exploration of alternative procedures, and discussion of ways to achieve
better team member coordination.

There are a number of limitations in the available studies which fit into
the matrix, beyond the small number to begin with. First of all, the research
focused on small teams of from two to six persons. Therefore, team skills
training within the context of large teams and between teams could not be
examined. Secondly, the team context was not addressed in any study. There-
fore, no conclusions could be reached about the utility of training team
skills to teams which will remain intact versus teams which are only temporary.
Finally, the only clear trainee characteristic which could be identified was
whether teams consisted of military personnel or civilians. Such issues as
team member task competence, previous team experience, and motivation were

not addressed. All of these are important issues. However, at the same time,
their absence does not detract from the primary conclusion reached from the
matrix research. Team skills training targetted on coordination communications
can change these communications in a way likely to contribute positively to
team performance in tasks requiring coordination.

TRAINING RESEARCH ISSUES DISCUSSED IN THE TEAM SKILLS LITERATURE

As we indicated earlier, team skills and team training in military context
have been addressed in a number of different reports. In reviewing these
reports, we found four recurring themes which are related to the conclusions
we arrived at from the research matrix. They cover the nature of team skills,
their operationalization, criteria for evaluating their impact, and task
dimensions associated with team skills. Let us consider each one in turn.

In discussions of the nature of team skills, the primary common elements
running through the reviews include coordination and interaction. For example,
Hall and Rizzo (1975) in their survey of Navy training personnel found that
the primary purpose of team training was believed to be teaching coordination.
This involved developing complementary or supplementary behaviors among team
members. Alexander and Cooperband (1965) saw team training as involving
coordinated activity required by the uncertainties of the task and situational
contexts. The Rand report (1980) on improving training of Navy teams also
emphasized the need for adaptive training to achieve coordination of unrehearsed
actions.

Interaction was stressed by Wagner et al. (1977) who indicated that team
training is a necessary addition to individual training for tasks requiring
interaction and "other team skills." Moreover, Nieva et al. (1978) in defining
team skills as team performance functions refer to these functions as
indicators of what a team does in the interactive effort to get work done.

Coordination is defined by Steiner (1972) to consist of decisions as to
who is to do what, when. Obviously, making these decisions and carrying them
out relies on interactions among team members. Therefore, interactions can be
viewed as an inherent part of the coordination process. Moreover, other team
skills which are mentioned within the literature seem to relate to coordination
in one way or another. For example, collaboration as referred to by Hewitt,
O'Brien, and Hornik (1974) involves interactions among team members as they
make mutual adjustments to carry out interdependent tasks. Cooperation as

referred to by Alexander and Cooperband (1965) includes learning other team member needs and pacing activities to fit these needs. Team adaptation functions as described by Nieva et al. (1978) include team member mutual adjustments to complement each other in accomplishing the team task. This is said to encompass "cooperation." It is difficult to see clear-cut, practical distinctions among these team skills labels. Rather, they all seem to focus on interactions among team members required as they work together to accomplish a task whether the interactions are called coordination, collaboration, or cooperation.

In addition, there are a number of dimensions discussed in the literature as team skills which may be more appropriately viewed as part of the support system for team skill or coordination effectiveness. For example, there is team or system awareness which Biel (1962) defines as an understanding of the interrelationships among work roles and tasks. It incorporates what is referred to in the RAND report as empathy toward roles played by other team members. This type of understanding may contribute to the practice of effective coordination by team members but it is not a direct part of the interactive process they are engaged in. As Hall and Rizzo (1975) point out, team awareness is best viewed as a social condition affecting team coordination.

Another example of such a support system is team member motivation which Nieva et al. have pointed out includes team performance norms, performance rewards, and team orientation. These contributors to motivation help to determine the extent to which individual team members will expend effort to achieve effective coordination. A final example of a support system involves knowledge of results or performance feedback. This topic has received considerable attention in the team training literature. (See Briggs & Johnston, 1967, for a review of the research on knowledge of results). Knowledge of results can be viewed as a direct part of the coordination process as team members respond to each other's actions. However, in a more formal sense as represented through supervisory performance feedback or equipment feedback, knowledge of results supports team coordination by providing team members with information on past efforts which point to requirements for future improvements.

Directly related to the nature of team skills is how to operationally define them. All of the reports reviewed noted this issue as a major problem facing team skills training, evaluation, and research. For example, Hall and Rizzo (1975) noted that coordination viewed as a type of interactive behavior is difficult to describe, define, or measure. Wagner et al. (1977) cited the need for unambiguous operational definitions of skills such as coordination, integration, and cooperation. On the other hand, there was less clarity on how to resolve the problem. Where attempts were made, the focus was placed on functions or activities performed by team members working together. Nieva et al. (1978) specified four team performance functions with from three to six subcategories. The functions are team orientation, organization, adaptation, and motivation. Actual behavioral or interactive operationalization of these functions and their subcategories was left for future research. Alexander and Cooperband (1965) and the RAND (1980) report stressed team strategies for conveying information and making decisions. Both reports singled out an interest in how interactions among team members resulted in coordinated activities under varying task and situational conditions. However, the specific combination of interactions or coordination strategies defining a team skill or a skilled team were left for others to determine.

The third theme covered in all of the team skills reports consists of the issue of performance criteria for team training. This theme encompasses more than operationalizing team skills per se although that is certainly an element. It raises a more fundamental question of the overall objectives of any team training program. If a case is to be made that training persons as teams yields critical benefits beyond training persons as individuals, then criteria for team training accomplishments must be specified. As Hall and Rizzo (1975) pointed out, training objectives on intended course outcomes are notably absent in most training programs. Collins (1977) stressed the need for objective, situation specific measures of team training achievement and effectiveness.

Beyond the issue of the benefits of team training which simply brings persons together is the more specific issue of whether team training which targets team skills is beneficial. As indicated in the reports, team training at the general level has not been adequately evaluated. However, the focus

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here is on specific team skills training and this is where the operationaliza-
tion of team skills becomes critical. As Nieva et al. (1978) note, the basic
questions involve what team skills are to be trained and how team proficiency
will be measured in terms of those skills. The literature provides no clear
guidance on the criterion issue.

The final theme has a much clearer direction. This theme addresses task
dimensions which should be used to identify appropriate tasks for team
training. The basic distinction made here is between structured, predictable
tasks and unstructured, evolving tasks or what Boguslaw and Porter (1962)
refer to as established and emergent tasks. All of the reviewers agree that
team training should focus on emergent tasks where there are significant
requirements for teams to adapt to changing task and situational conditions.
Under these conditions, as pointed out in the RAND report, team members must
not only change behaviors but also coordinate new behaviors. Nieva et al.(1978)
add task interdependence to task emergence as a second dimension for determin-
ing team skill requirements. In other words, emergent tasks must also be
characterized by significant requirements for team member coordination for
team skills training to have an impact.

Referring to these two dimensions, if we were to look for tasks where team
skills training has the highest likelihood of impact, we would consider what
Alexander and Cooperband (1965) refer to as high task load conditions. These
would be tasks where unstructured events occur rapidly under time stress, where
there is a heavy demand placed on coordinated information processing and other
team member activities, and where there is "noise" in the input. We might
characterize such task types in the extreme as "emergent emergencies." Such
task conditions place heavy emphasis on team adaptive strategies and procedures
as they are expressed through team skills like coordination.

RELATIONSHIP OF REVIEW THEMES TO TEAM SKILLS TRAINING RESEARCH

We have just discussed how the nature of team skills, their operationalization, criteria for evaluating their impact, and task dimensions associated with team skills are viewed in the open literature. We will now take a look at how these views relate to the findings of the research reported in the team skills training matrix. Our first conclusion from the review was that the nature of team skills could be described parsimoniously as focusing on the competence of team members in coordinating their separate tasks or activities. Other labels such as collaboration or cooperation basically describe the same skill process. Moreover, team member interactions which also received much attention in the reports as a team skill are better viewed as the "delivery system" for coordination. This perspective is supported by the research in the team skills training matrix. The Krumm and Farina (1962), McRae (1966), Siegel and Federman (1973), and Thurmond and Kribs (1978) studies all targeted coordination. Moreover, the first three of these studies did so by looking at interactions among team members

A number of dimensions were covered in the reports which we felt were more appropriately viewed as part of a support system for team skills. They included team awareness, knowledge of results in certain forms, and team member motivation. While none of these specific dimensions were addressed in the matrix studies, certain aspects of support systems were covered. For example, Federman and Siegel (1973) and Thurmond and Kribs (1978) made use of task follow-up discussions to examine performance, discuss roles, and plan future task strategies. Shure et al. (1962) and Hackman et al. (1976) allocated planning time and provided planning strategies for teams. These types of sessions can be considered as providing support for team skill competence by allowing teams to develop interactive strategies while not actually practicing coordination skills. Presumably, this reduces the task load pressures which occur during actual team task performance.

The second theme raised in the reports which we reviewed involved the issue of operationalizing team skills. No clear-cut guidance was found on this issue. However, where there was more discussion than simply

acknowledging this to be a critical problem, the emphasis was on delineating
functions and activities performed in a team which characterized a team skill
construct. Again, it is important to emphasize that a team skill construct
is simply a convenient label used to describe a class of events, objects, or,
in this case, behaviors. Therefore, if coordination is the target team skill
it must be operationally defined in terms of behaviors or interactions con-
sidered by researchers, a panel of training experts, or someone else to
represent coordination-in-practice. In the research matrix where coordina-
tion was the target team skill, it was operationized in terms of communications
content categories by Krumm and Farina (1962), McRae (1966), and Federman and
Siegel (1973). For example, Federman and Siegel developed the four factors
of evaluative interchange, hypothesis formulation, leadership control, and
conditional "what if" statements while McRae used eight (8) organization
and task-specific interaction categories. Thurmond and Kribs (1978)
operationalized coordination in terms of the task requirements for team
members to work together. The primary emphasis in the research studies is
placed on operationalizations in terms of actual team member interactions.
Moreover, the nature of the interactions which characterize the coordination
construct may vary from one task to another.

The third theme discussed was performance criteria for team training.
These criteria were found to be noticeably lacking at even a general level
to allow comparisons between team and individual training. The importance
of separating team skills criteria from performance criteria when evaluating
the impact of team skills training is shown in several of the matrix research
studies. For example, Siegel and Federman (1973) found change in the practice
of coordination operationalized in terms of communications categories for
experimental groups. However, there were no significant differences in per-
formance between experimental and control groups with no coordination training.
The fact that the coordination training had an effect on communications led
the researchers to look for possible explanations as to why no performance
differences were discovered and they found that crews in the control teams
had more task experience initially than crews in the experimental condition.
Moreover, in studies where performance change is found, separate indicators
of team skills change help to support the relationship between team perform-
ance and team skills competence as demonstrated in the Shure et al. (1962) and

Hackman et al. (1976) studies. Longitudinal and experimental-control group research incorporating objective measures of team skills are effective methods for evaluating the utility of team skills training. However, clear-cut performance measures are critical to this research. The approach taken in the matrix research studies was either to use training devices like simulators where such measures were available or to develop laboratory exercises with such criteria built into them.

The final theme which we covered addressed the nature of task dimensions where team training is appropriate. Emergent tasks with interdependent sub-elements were found to be the primary dimensions discussed in the reports. Studies by Briggs and Johnston (1966) and Thurmond and Kribs (1978) in the matrix emphasized the importance of task interdependence by showing that only for tasks requiring team member coordination will the practice of such a team skill improve performance. The emergent task dimension was not con- sidered directly in the matrix research as there was no evidence of intentional variation of task conditions in any of the studies. However, Siegel and Federman (1973) and Hackman et al. (1976) noted the increased flexibility in team member strategies and modification of perspectives after the occurrence of team skill interventions.

CURRENT STATUS OF TEAM SKILLS TRAINING RESEARCH

The nature of team skills, their operationalization, team performance
criteria, and task dimensions all must be considered in formulating and
conducting team skills training research. Figure 2 draws upon the discussion
of these themes as they are covered in the review and training research
literatures to summarize a model for team skills training research. At the
left of the model are team skills. We have singled out coordination as the
primary team skills construct because we feel that it adequately represents
competence in working together which is the basic characteristic of a team
skill.

At the heart of the model are interaction behaviors which form the opera-
tional definition for the team skill. While some writers have expressed dis-
satisfaction with the emphasis placed on interactions and communications in the
team skills literature, we see no alternative at the present. Interactions
among team members are the forms which team skills assume. Moreover, the nature
and content of these interactions which define competence in coordination may
vary from one task to another. Therefore, coordination as a team skill may have
to be defined differently as a function of the task context in which it is
being applied.

We consider support systems to be critical to the development of training
programs to improve team skill competence. Attempts to train team members
directly on appropriate types of interactions are likely to fail because of
the unrealistic requirement made of team members to actively monitor their
interactions themselves. What is more likely to work is the development of
task structures, strategy discussion procedures, and performance feedback
mechanisms which encourage certain types of team skill interactions to take
place. Some types of supports could be useful both during team training and
as part of on-going field team activities. For example, procedures designed
to aid a team in discussing adaptive coordination strategies for novel task
conditions during team training could be used for similar purposes in real-
world settings. Team leadership is also an important part of the current
system. Leadership tends to be ignored completely in the team training
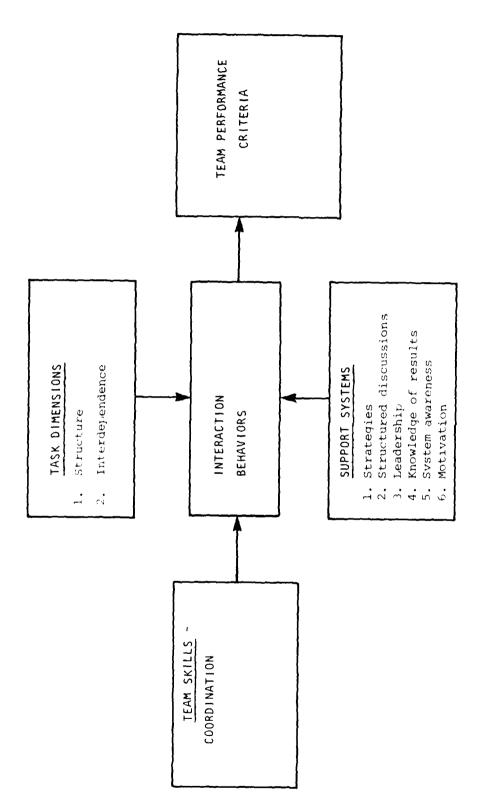literature. However, given the leader's role in military teams and in other

Figure 2.   A Conceptual Model for Team Training Research

her influence on task structure and team member interactions, it is
necessary to build formal leadership into team skills training research.

The model also shows that task dimensions are an important consideration
as they influence team member interactions. It is obviously desirable to
focus team training research on tasks where team coordination interactions
are most likely to make a difference. Unpredictable, evolving tasks with
interrelated sub-elements seem to best represent this requirement.

Of equal importance is clearly establishing the linkage between team
coordination communications and team training performance criteria. This
entails not only the delineation of valid team performance measures but also
the establishment of valid team skills interaction measures. It also involves
the identification and measurement of other training interventions in addition
to those involving team skills which may contribute to a change in team
performance.

One fact which became obvious to us early in our literature review was
the limited amount of research available where specific team skills inter-
ventions had occurred. This lack of research activity was noted by Campbell
in his exploration of training research for the Annual Review of Psychology
in 1971 where he indicated that training teams as coordinated units should
be a more active research topic given its potential importance in organiza-
tions. Nine years later in the same publication, Goldstein (1980) reached
a similar conclusion noting that "in view of repeated calls for more under-
standing of team training, the lack of theoretical and empirical work is
disappointing (p. 237)." Moreover, Collins (1977) figured out that an
average of less than two training research studies per year were conducted
between 1970 and 1976. Our review for the team skills training matrix
covered fourteen relevant research studies and we had to extend our defini-
tion of team skill intervention to include non-training as well as training
research contexts.

Team skills training research has been difficult to conduct particularly
given the fact that research on the impact of team skills on team perform-
ance has not provided much guidance. If there is to be any real support for

team skills training research in the Navy, the immediate requirement is to
demonstrate the value of team skills targetted training in straightforward,
short-term research studies. Previous research which might serve as a model
for such a study is the work done by Siegel and Federman (1973). Let us
briefly describe how this study fulfills the requirements laid out in the
model for team training research in Figure 2.

Siegel and Federman began with a content analysis of communications
data collected from teams performing on an anti-submarine helicopter simula-
tor. Twenty-eight communications categories were used which were found
through factor analysis to yield three consistent dimensions across two
separate data collections. The factors included providing/requesting
information and options, evaluative interchanges, and providing/requesting
opinions. It was then determined that these communications factors were
related to independent measures of team proficiency in the performance of
the anti-submarine warfare training tasks. Therefore, at this stage of the
study, the researchers had operationalized coordination team skills in terms
of identifiable and measurable interaction behaviors for a specific training
task. They had also demonstrated that these team skills related to team
performance criteria.

The next step in the research was to build the team skills into the
training program. This was done through follow-up structured team discussions
of earlier task performance where instructors kept focusing on the three
communications factors. Role-playing exercises were also used to simulate
real situations where team member roles were designed to incorporate positive
and negative interactions suggested by the communications factors. These
two activities formed the support system for developing the interactive team
skills.

The evaluation of the impact of the team skills training involved
comparing the performance of sixteen teams which engaged in this training
with sixteen control teams. The relevant communications team skills of both
sets of teams were also compared. The results showed that the team skill
trained groups exhibited more frequent communications across the critical
interaction categories. However, no significant performance differences were

discovered between the two sets of teams. Unfortunately, the control teams had more experience in performing the task which may have accounted for the results.

While the Siegel and Federman research did not yield significant performance differences between team skill trained and untrained groups, it still serves as a prototype for what is required to establish the targets for and utility of team skills training. The first step involves the identification of team skills operationalized as interaction behaviors which relate to team performance criteria for a given on-line Navy training task. Primary focus should be placed on emergent tasks with substantial requirements for team member interdependence since these types of tasks are most likely to have significant team skill - task performance linkages. The second step is to determine support systems for critical team skills. These systems include formal team training scenarios and aids as well as team strategies for emphasizing and reinforcing team skills. These strategies could incorporate structured discussions as well as aspects of leadership, knowledge of results, system awareness, and motivation. The third step in the research effort entails actual evaluation of the impact of the team skills targetted training. Standard experimental - control group and longitudinal research designs are necessary. Moreover, as we have already emphasized, it is important to have separate measures of team skills interactions and team performance so that any relationships between them can be clearly demonstrated.

Given the current status of team skills training research where there are few examples of studies which include these three steps, it is important to show that team skills targetted training does make a difference in the performance of critical Navy tasks. The first studies should focus on emergent, interdependent training tasks with explicit, straightforward performance criteria. Team coordination skills should be operationalized in terms of interaction content. Various content coding schemes are currently available to categorize team interactions (e.g., Bales, 1950; Rosen, Billings, & Turney, 1976). These systems can be custom-tailored to meet practical task requirements. Initial studies should be short-term and low cost with

simple team training inputs similar to the team member discussion scenarios and role-playing exercises used by Siegel and Federman. This type of study will satisfy essential initial requirements for addressing gaps in current research and establishing justification for more substantial future research on team skills training under complex team task conditions.

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